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Editorial

Food and National traits: We publish elsewhere in this issue some observations on human behaviour under experimental semi-starvation and subsequent rehabilitation. Nervous tension, emotional instability and irritability were very marked features observed in all the subjects under study. Humour dried up and the tone of the group became very sober and serious. Apathy was very marked, except in relation to food and curious forms of acquisitive behaviour were developed, perhaps as a compensation for food deprivation. During rehabilitation, recovery from apathy was very rapid and gradually social and cultural interests too, reappeared.

This experiment opens up an interesting line of thought, as to how far our chronic food shortage affects our national traits and characteristics. We must admit that as a nation we are rather deficient in the saving grace of humour, and rather too prone to carry ideals to extremes and not sufficiently realistic to tackle our everyday problems in the most effective manner. There is also an irritability which finds expression in a narrow, legalistic approach to all questions of social and cultural advancement. The underlying factor of all these features would seem to be our chronic under-nourishment. The well-known Chinese writer Lin Yutang has suggested in one of his essays, formulae for depicting the national traits of different countries. Thus the Englishman is made up of 3 grains of realism, 2 grains of dreams or idealism, 2 grains of humour and 1 grain of sensitivity, giving a "national formula" of $R_3 D_2 H_2 S_1$. Corresponding formulae for other nations are $R_3 D_4 H_1 S_2$ for the Germans; $R_2 D_4 H_1 S_1$ for Russians and $R_2 D_3 H_1 S_1$ for the Japanese, all these three being deficient in a sense of humour and abnormally high in idealism, which makes them susceptible for dictatorships. The Americans have a formula of $R_3 D_3 H_3 S_2$, more or less similar to the English, but with a higher degree of idealism and sensitivity. As

Lin Yutang points out, the Americans are tremendously enthusiastic nearly all the time about something or other. On the whole, the English would seem to have the soundest national make up, their R_3 making for emotional stability and a realistic approach to all problems and their keen sense of humour enabling them to pull through with a smile, out of all sorts of difficult situations. We Indians have not been a free nation long enough to develop national traits as yet, but if one might be attempted on Lin Yutang's model, it would be R_2 D_4 H_1 S_3. This formula draws attention to our excessive idealism, and sensitivity (what other people would term "touchiness") a deficiency of humour and sense of realism. We have of course a biological explanation for this, in our chronic under-nourishment, but it cannot serve as a justification. The remedy too, is obvious, being nothing less than a concerted drive to improve food production in the country and raise our national dietary from semi-starvation, to an adequate level.

NOTICE TO SUBSCRIBERS.

The cost of printing and paper is still high. We appeal to such of our members as are in arrears and other members to kindly remit their subscriptions early.

How the Chemistry Section helps the farmer *

By

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One of the chief functions of the Chemistry Section is advisory. Practically every day letters are received from ryots of the Province requesting advice regarding soils, manures or waters, manurial requirments of crops, suitability of lands for various crops, reclamation of alkaline soils etc. Advice is tendered based on analysis and on experience. In addition the officers of this and other departments, manurial firms and Indstrialists make use of the section for similar advice which finally reach the farmer. In this connection two to three thousand of what may be termed advisory samples of various kinds are analysed every year. It is fortunate that the section is thus brought in close contact with the problems and the needs of the ryots since it enables the designing of research programmes primarily to attack his day to day problems. How this has worked in actual practice is recounted below :—

Past Work: (a) Rice being the main food crop of the Province, the chief rice areas, namely the deltaic regions of the East Coast, the rainfed rice areas of Malabar and the Periyar Project ayacut in Mathurai were systematically surveyed for their plant food content. Based on the survey, a manurial programme for paddy was formulated for adoption and experimentation in the research stations located within these soil-climatic regions. The manurial trials in these stations, particularly those conducted in the past ten years in the internationally accepted scientific manner bave shown that the manurial programme formulated then was sound. Recommendations are now being made to the ryot regarding the manurial requirments of rice with the confidence engendered by long years of research.

(b) The sudden appearance of alkalinity after a lapse of several years in some of the great project areas, such as Assuan Dam, Sukkur barrage, Nira Velley etc., gave rise to the fear that similar alkalinity may arise in the Tungabhadra Project area also. To settle this question, the area was surveyed and this has enabled us to conclude that due to the presence of a porous *garusu* layer at the lower depths, the rise of salts to the surface on application of

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* Paper read at the 32nd Collage Day and Conference.

water need not be feared. This has been corroborated by the irrigation experiments conducted at the Agricultural Research Station, Siruguppa where no rise of salts was noticed even in wet lands. In addition to this all-important information, the survey has furnished much knowledge regarding the soils of the project area in various other directions, such as depth of soils, their physical, chemical and biological status, etc., all of which are finding their way to the farmers in the locality in the shape of advice.

(c) The newer knowledge of Base Exchange in soils led to the adoption of gypsum and organic matter as the agents for reclaiming alkaline lands in Tiruchirapalli district with great success. Starting from scratch on a land where not a blade of grass grew before, the land was reclaimed within three years and the crop at the end of this period yielded 3,000 lb. of paddy per acre. In view of the occurrence of extensive deposits of gypsum in Perambalur and Ariyalur taluks, this method is recommeded as suitable for the speedy and economic reclamation of alkaline lands especially in the Tanjore and Tiruchirapalli districts. Many enlightened ryots are already adopting this process with advantage.

(d) Experiments with bullocks conducted by the Chemistry Section enabled the formulation of feeding standards for maintenance and for various levels of work such as mhoting, ploughing, carting etc. These recommendations are now being followed in all the Agricultural Research Stations. The adoption of these standards has resulted in much savings in the cost of maintenance of work animals. Some of the enlightened farmers are already taking advantage of the recommendations. Apart from the formulation of feeding standards, the importance of the minerals, Calcium and Phosphorus, has been brought out by these experiments. To-day the mineral mixture has become very popular with the farmer and many of the prominent manure firms carry it as an item of their regular stock.

Present Programme: As in the past, the present investigations are designed with the primary object of benifiting the farmer. The more important items are explained below :—

(e) Investigations are in progress in ryot's fields and in the Agricultural Research Station, Koilpatti, in the Tirunelveli district, with the object of rehabilitation of marginal lands in dry areas on the lines of experience and success achieved by the T. V. A. plan. In brief, the method consists in growing a legume on the

marginal lands with the application of Super-phosphate and the seeds inoculated with their specific root-nodule bacteria prior to sowing. The first flush of the legume crop is utilised as fodder and the second growth is ploughed in. A grain or a cash crop is raised subsequently. This is repeated every year until the cumulative effect improves the productive status of the soil. The success of the plan depends upon adequate rainfall from June to September, not only for the good growth of the legume but also its quick decomposition in the soil when ploughed in.

Last year in the Agricultural Research Station, Koilpatti, the legume gave only about 500 lb. of green matter due to the failure of the South-West monsoon. Yet the analysis of soil after the harvest of the subsequent grain crop shows a small but definite improvement in its organic matter status and base exchange capacity.

(f) There are about 30,000 acres of alkaline lands in the Cauvery-Mettur Project area which need to be reclaimed. A suitable area in a ryot's field has been selected near Pattukottai to serve as a model for adoption for the reclamation of the alkaline lands. Several ameliorants, such as gypsum, green leaves, lime, molasses etc., have been included so as to afford visual demonstration of the speed and cost at which each brings about the reclamation. The farmer himself could select the ameliorant most suited to him.

(g) The cry in the Nilgiris is that the cost of production of potatoes is too high, mainly due to the heavy dosages of manure that have to be applied. The Nanjanad formula calls for 1,600 lb. of mixed manure per acre over a basal of 5 tons of cattle manure or compost. While it is admitted by all that the dosage is heavy, the laterite soils coupled with steep slopes of the Nilgiris demand heavy dosages of manure to maintain the high productive level. An experiment has been initiated this year to explore this problem to find out if the dosage could be reduced, maintaining at the same time the high yields. This is sought to be achieved by altering the proportions of N. P. and K. and by resorting to indirect phosphate manuring to the leguminous green manure crop preceding the potato.

(h) Work done on the isolation of specific root nodule organisms for leguminous plant groups has enabled the supply of the right bacterial culture for practically all South Indian legumes. Requests for cultures are being received daily from ryots indicating their appreciation of the effect of inoculation.

(i) Studies have been in progress for the past few years in Wetlands, Central Farm, to obtain information for Coimbatore-soil-climatic zone regarding the most suitable green manure for paddy. The periodic visitation of drought in this district has been kept in mind while attacking the problem. Of the four green manures studied, Dhaincha, Sunnhemp, Pillipesara and Cowpea, Dhaincha was found to be uniformly superior to others particularly in droughty years.

In these various ways the Chemistry Section has been endeavouring to reach the farmer every time an investigation is designed.

On the occurrence of *Musa balbisiana* Colla., in S. India and its importance in banana breeding

By

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Musa balbisiana Colla., has not hitherto been recorded as such in Indian literature on *Musa*. The species, however, has been found growing in certain tracts of this country for ages now and has been ranked as *Musa sapientum* (Roxburgh, 1824; Kurz., 1866), that mythical species, which is "the most confounded and confusing combination in the whole literature of *Musa*" (Cheesman, 1948a).

The classification of the bananas, more so that of the entire genus *Musa*, has been a much vexed problem; this has been discussed at some length elsewhere (Cheesman, 1934, 1947, 1948b; Venkataramani, 1946). The reasons for the existing chaos in the taxonomy of the bananas are very many indeed, but the confusion to group this seemingly distinct species as some other species may in part be due to the inaccessibility of the literature on *Musa* scattered in various journals not easily obtainable to the banana worker. Colla's original description of this species has been transcribed in a recent publication on the classification of the bananas (Cheesman, 1948a), in which is also given a generalized description of the species. It can be summarised as follows:

Plant suckering freely; pseudostems robust, green or pale green; leaf blades oblong, truncate at apex and rounded or slightly cordate at base; petioles long, their edges almost meeting over the

concave adaxial channel, margins developed in the lower regions and closely appressed to the pseudostem. Infloresence is pendulous, peduncle glabrous, "heart" or male bud ovoid or ellipsoidal, bracts imbricate at the blunt apex; bracts rounded at apex, often with a green or yellow tip, more than one lifted at the same time, thus exposing a number of clusters of male (staminate) flowers simultaneously; bracts usually deciduous and occasionally persistent in a withered condition, especially in the later stages of blooming. Fruit bunch pendent and compact; individual fruits small, about 10 cm. in length and 4 cm. in diameter, angulate at maturity, abruptly narrowed at base into a short pedicel, and gradually at the stigmatic end into a short and broad beak; rind thick, pale yellow in colour when ripe; pulp whitish and with seeds; seeds black, irregularly globose, scarcely depressed, and about 5 mm. in dimension.

The above description agrees in most essentials with that of a wild seeded banana growing in certain parts of S. India and variously referred to as "Ela Vazhai" at Madras, "Ginjali arati" in the Circars and "Kallu Bale" in parts of S. Kanara district. This species has also been recorded from Ceylon and Mysore (Cheesman, 1948a). This again is quite distinct from the few other wild sorts growing in the S. Indian forests.

The importance of this species lies not so much in its mere occurrence in S. India as in the possible role that it might have played in the evolution of some of the edible bananas. A study of the numerous edible bananas will reveal the enormous diversity met with in the 'banana complex'. In a tentative classification of the South Indian bananas all the edible varieties are grouped under one species, ***Musa paradisiaca*** L. (Jacob, 1934). Our knowledge of the various species of ***Musa*** occurring in this country is rather inadequate in that many of the wild species have not yet been critically studied; a new species of *Musa*, *M. Agharkarii*, has been recently recorded from the Chittagong Hill Tracts (Chakravorti, 1948) and possibly there are some more which are not known to science. A detailed investigation of the taxonomy of the genus ***Musa*** as occurring in this country and also on the inter-specific hybridization, especially, with the species of the section *Eumusa*, may be expected to throw some light on the real status of our edible horticultural varieties — whether they are all varieties of one and the same species or they are derived from various sources. This is especially desirable before a classification of the cultivated

bananas is attempted, as work done elsewhere on banana breeding suggests that the origin of the edible bananas for the most part can be traced to three sources, one of which is of hybrid nature and the remaining two being associated with the natural species, *Musa acuminata* and *Musa balbisiana* (Cheesman, 1948b). Also, hybridization between these seeded species and the synthesis, from this inter-specific cross, of an edible banana closely resembling an established horticultural variety. Dodds and Simmonds, (1948) suggest that some of the edible bananas may after all be natural hybrids ingeniously propagated by man to meet his requirements. Some of the South Indian banana varieties show some of the characteristics of *Musa balbisiana* and the occasional seeds met with in some of them resemble to a great extent those of that species.

Musa balbisiana has been reported to have a wide geographical distribution; so also the other natural species, *Musa acuminata.* The writer is not aware of the occurrence of the latter species in S. India; it has, however, been recorded from Assam. The presence in this country of these two important species of the section *Eumusa*, which includes most of the bananas, can be taken as an indication of the diverse origin of our bananas, and it is hoped that these wild species will form useful parent stocks in any banana breeding programme contemplated in this country.

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Embryo-culture and its use in plant breeding

By

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Introduction: In view of the growing significance attached to embryo-culture in recent years in experiments with plants, an attempt is made in this paper to describe in some detail the evolution of the embryo-culture and its achievements in the field of plant breeding, besides giving some newly recorded observations made by the author in his embryo-culture work in maize.

Embryo-culture defined: Briefly told, *embryo-culture* means culturing of excised embryos in an artificial medium and attempts at imitating nature, in that the essential food materials and conditions of growth that the embryo otherwise gets from within the ovule are artificially supplied to it. The term *embryo-culture* ordinarily refers to the culturing of mature or slightly immature embryos. Culturing, however, of very young embryos is termed *pro-embryo culture*. In a normal diploid seed the growth of the embryo and the endosperm go apace. It is found, that so long as the chromosomal complements of the different parts of a seed, namely, the embryo, the endosperm and the seed coat bear to each other a definite ratio, for example, 2 : 3 : 2 in a fertilized maize ovule, there is harmonious development for these different parts from the time of fertilisation to the final stage of maturity resulting in a normal fertile seed. But whenever this proportion gets upset as it occurs in a wide cross even after triple fusion, there is disharmony in the growth pace of these different parts. If the endosperm acquires a comparatively lower complement of of chromosomes than the embryo, than the growth pace of this is slower resulting in an arrest of the normal growth and subsequent collapse of the embryo. The term *pro-embryo* in a wide cross refers to the growth period of the embryo before this collapsible stage is reached.

The basic idea of embryo-culture was first conceived in Germany about 50 years ago. Hannig in 1904 in Germany grew embryos from *Raphanus* and *Cochleria* to maturity after they had been removed from their ovules when they were about 1·2 m.m. long (LaRue, 1936). Stingle in Germany in 1907 (LaRue, l. c.) grew embryos of several grains in the different cereals in the endosperm of other species. White in 1902 grew embryos of

Portulaca oleracea that were much smaller than those bred by Hannig and disproved the assertion of Dietrich in 1924 that embryos less than $\frac{1}{3}$ the normal size could not be grown in the culture medium (LaRue, l. c.). He could not, however, secure continuous growth for the embryo which stopped growing after 3 weeks. The growth of sweet cherry embryos in an artificial medium was reported by Tukey in 1933 and 1934. Carl D. LaRue 1936, grew immature embryos of both dicots and monocots to seedling stage in the culture medium. He failed, however, to grow an embryo less than 5 m.m. long into seedling stage.

The growth and development of the culture medium as it is in use today

(a) *Agar as base for the medium:* Since the time of Hannig agar media of varying concentrations have been in use for embryo culture. It has been used from $\frac{1}{2}$ to 10 percent. Although 10% has been found favourable with some in America, it is found that the embryos fail to develop in this as uniformly as in low concentrations. Half and one per cent have given good results and 0·6% generally speaking, appears to be ideal. At this concentration, there is enough water available which is necessary to support a growing embryo, at the same time, possessing sufficient degree of viscosity for the medium to support the embryo on the surface.

(b) *Salt content of the medium:* Various salt solutions named after their advocates, have been in use. Pfeffer's, Knudson's modified solution, Upanski's, White's, Crone's modified solution, Knopp's complete nutrient solution, Tukey's and Randolph's are some that may be mentioned. All these have more less the same complement of mineral elements, but in different forms and proportions. Tukey is of the opinion that there is no appreciable difference in effect between the different salt solutions used by various workers. The concentrations could be varied from 1 to 10 times with no appreciable effect upon embryos or seedling development so long as the concentration did not exceed that which is toxic to the plant (Tukey, 1934). Tukey's basic medium has KCl, $CaSO_4$, $MgSO_4$, $Ca_3(PO_4)_2$, $Fe_3(PO_4)_2$ and KNO_3 for its ingredients and is now widely in use for embryo culture work. One of the advantages of Tukey's mixture is that the salts may be ground, thoroughly mixed and placed dry in a stoppered bottle and used over a period of months. The solution used by Randolph is essentially that of White, excepting that instead of KH_2PO_4, he used Sodium-hexa-metaphosphate $(NaPO_3)_6$. It is prepared in two stock solutions

and mixed together at the time of use. $(NaPO_3)_6$ forms a soluble complex with both iron and calcium and eliminates the difficulty inherent in most other mixtures in retaining in solution the small amount of iron necessary for optimum growth (Randolph, 1945).

(c) *Sugar in the medium :* Sucrose, Glucose and Fructose have been in use in varying quantities. Sugar has been found necessary for inducing chlorophyll development in the embryo in the very early stages, as otherwise, it does not grow. Therefore, the strength to be used depends upon the stage of development of the embryo to be cultured. Growth of more fully developed embryos is inhibited by sugar. Preferences for the particular form of sugar appear to vary with different plants. For a general purpose medium, to cover the range of requirements of both young and old embryos, 5% sugar as sucrose appears to be optimal.

(d) *Growth promoting substances :* The utility of growth promoting substances in embryo-culture was recognised as early as in 1922 by Knudson. Heteroauxin, indolacetic acid, glycocoll, propionic acid, adenine, thiamine, ascorbic acid, succinic acid, nicotinic acid, panto-thenic acid and Vitamin B_6 are some of them in common use. Natural extracts from Canna tubers, Carrot, Garden beet, Coconut meal, Datura ovules, Almond meal and Yeast have been found to help embryo growth. Van-Overbeek (1941) found in coconut water, an active growth promoting substance. He found that young Datura embryos were particularly responsive to coconut water. He tried the growth of a 10–day–old Datura embryo measuring less than 0·5 m.m. in Tukey's general purpose medium to which were added some of the physiologically active substances indicated above in certain proportions fixed on a purely arbitrary basis (Van-Overbeek, Conklin and Blakeslee, 1942). The embryo failed to grow. However, when coconut water was added to this, there was better growth of the embryo. In 1942, Van-Overbeek succeeded in extracting embryo factors from coconut water by fractionation process. He showed for this fractionation product, an embryo activity in a dilution of 1 : 4,000 parts, compared to 1 : 110 parts for untreated coconut water. With the help of this he was able to grow a 0·45 m.m. long embryo several times more than by using cocoanut water as such. But roots did not develop, evidently due to a root inhibitor. This was removed by further fractionation. The new preparation showed a factor activity at a dilution of 1 : 19,000. Using this he was able to grow an embryo 0·45 m.m. long into a perfectly normal seedling (Van-overbeek, 1942).

Van-Overbeek and his associates were able to culture very young embryos of Datura aged ten days and measuring only 0·15 m.m. long into normal seedlings with these fractionation products.

Uses of Embryo-culture: The uses of embryo-culture in plant breeding can be considered mainly under the following three heads,

(a) *Culturing of slightly immature embryos:* Culturing of embryos removed out of slightly immature seeds, helps to grow readily, seedlings from such seeds that otherwise do not germinate when mature, until after the dormant period (Goff, 1900).

(b) *Culturing of mature embryos:* Culturing of embryos excised out of mature seeds, helps quicker germination in seeds that have hard and impermeable seed coats.

(c) *Embryo-culture in the pro-embryo stage to get up F-1. generations out of incompatible crosses:* In a wide cross the embryo sometimes grows normally but the endosperm surrounding it ceases to grow or grows at a much slower rate so that the normal growth of the embryo gets arrested. Embryo-culturing just before this happens, in other words, in the *pro-embryo* stage, makes it possible to grow the embryo into a seedling. By this method Blakeslee working with *Datura stramonium* as one of the parents succeeded in securing species hybrids from combinations which had given only a single viable seed from many hundred pollinations (Blakeslee, 1944). In Blakeslee's own words, "we no longer have to wait for the chance hybridisation between species and the later rare spontaneous doubling of their chromosomes in order to secure such superior varieties. With the use of colchicine we can now make this to order, provided we have the sterile hybrids to start with. Thus embryo culture method should considerably increase the source of these sterile hybrids".

Some new lights on certain aspects of embryo culture as conducted and indicated below by the author in its use and application to breeding in maize.

(a) *Culturing of pro-embryos normal of diploid maize aged 3—7 days;* Previous workers on maize reported that 10-day-old maize embryos over 0·3 m.m. in length grew steadily in the culture medium (Haagen-Smit, 1945). They did not, however, indicate the reaction in a culture medium of a pro-embryo less than 10 days old. In the present experiment, culturing of pro-embrys aged 3—7 days

in Tukey's basic medium containing active growth promoting substances did not help to grow them into seedling stage. None of the embryos excepting the 7-day-old one showed any signs of growth in the medium (Uttaman, 1949). The 7-day-old embryo grew but ceased growth at the end of the 5th day. A similar case has been reported by White in 1932 (LaRue, l. c.). He was able to grow an embryo of *Portulaca oleracea* measuring only 0·12 m.m. to a size of 1·84 m.m. by adding a fibrin digest to his culture medium. The embryo, however, was unable to grow further at the end of the third week. It is clear that these active substances are not able to fully supplement the deficiency of natural hormones that this needs for its full development.

(b) *The effect of cocoanut water on the growth of immature embryos of maize :* In this experiment, it is found that cocoanut water has a decisive depressing effect on the growth of a 2-week-old maize embryo, although it does not totally inhibit its growth in the culture medium. Van-Overbeek in 1941, reported that in Datura embryo the roots did not develop in the presence of cocoanut water but the shoot did. This finding is not, then, in absolute agreement with the above results in maize (Uttaman, 1949 [2]).

(c) *A study in contrast of the effects of cocoanut water on the growth of immature embryos of maize when applied before and after germination of the embryo :* In this experiment it is indicated that the cocoanut water does help the growth of a maize empryo when applied after the embryo has started growing rather than when applied before germination, although Haagen - Smit (1949) reported no effect for cocoanut water on this. The reason for this differential behaviour in the embryo-growth in the present experiment may be found in the hypothetical suggestion that by the time the embryo starts to germinate the embryo factors decompose into certain toxic component parts which depress the germinating embryo and that most part of the opportunity to benefit by the embryo factors, is lost to it. That the loss of emryo factor activity of these natural extracts due to standing, heating, chemical actions etc., may be due to a release of toxic substances by their decomposition has been demonstrated by previous workers on Datura embryos (Van-Overbeek, Conklin and Blakeslee l. c.). It is further indicated that the embryo active property of any natural extract could be more readily and clearly understood by its application to the embryo after the latter has been initiated into sprouting than by application before germination (Uttaman, 1949 [3]).

(d) *Growth promoting factors in corn germ extract:* Lampe and Mills (1933) have reported the growth of 10-day-old embryos of maize in agar containing mineral salts, dextrose and extracts of young corn ovules. Aqueous extract of 2-week-old corn ovules was tried by the author without any spectacular effect on equally aged corn embryos. In this experiment, extract of sprouting embryos of mature corn seeds is tried on young corn embryos. The maize germ extract was prepared by finely macerating the germinal embryos of maize and then sterilising by Seitz-filtering under vacuum pressure as the extract may not be stable to auto-claving. The results of the experiment show that the maize germ extract has a marked beneficial effect, much more than of cocoanut water on the growth of a very young embryo of maize (Uttaman 1949.)

(e) *Embryo-culture to obtain F-1. plants out of incompatible crosses in maize:* Wide crosses usually do not set mature fertile seeds. Occasionally, one or more partially filled fertilised ovules are met with. These respond to embryo culture when young, although the mature seeds show indifferent germination. In the above experiment, 66 partially filled seeds were obtained from a cross between a tetraploid and a diploid maize plant. These seeds when pot sown gave only 15 P-1 plants of which one was a triploid. This was crossed to a tetraploid and the three partially filled seeds obtained from this cross were embryo-cultured when 16 days old. All the three, confirmed to be heteroploids by root tip studies, were reared into young seedlings. Embryo culture of very young seeds in this way helps to secure a greater percentage of F-1 plants out of incompatible crosses than by the ordinary method of germination of these seeds when ripe, by pot sowing (Uttaman, 1949 [5]).

(f) *A preliminary investigation into the viability of immature embryos of maize under conditions of cold storage at freezing point:* In any investigation requiring the dissecting out of several hundreds of embryos from immature kernels, any devise that preserve the young embryos inside the kernels from loss of viability should have a special significance, in that such an operation could then be conducted through several days without being obliged to do it all at one moment. From the present investigation, it is found that the viability of the young embryos of maize aged three weeks, could be preserved through a period of about 1½ months by keeping under cold storage at freezing point (Uttaman, 1949 [6]).

Culture technique: The embryo-culture technique mainly concerns itself with careful excising of the embryo from the seed and ensuring freedom from contamination by bacterial and fungoid infection of the embryo to be cultured.

The excising of the embryo out of a mature seed is best done after softening the seed coat by soaking for a day or two in water. If the size of the seed happens to be very small as in the case of a tomato seed, the operation can with advanage be effected by holding the seed between the edges of two mounting slides and then by dissecting with a fine razor blade. In the case of a very young immature seed, the excision is best done with the help of a fine needle and a scalpel under a preparation microscope. Employment of a fluoroscent light is advisable as the use of an ordinary incandescent light often seriously impairs the embryo, causing it to shrivel and die by the radiating heat. Freedom from contamination is gained by complete sterilisation of the culture medium and the containers on the one hand and on the other, by properly disinfecting the seed prior to the excision of the embryo, done under strict aseptic conditions. Sterilisation of the containers is best done by first cleaning the bottles and the caps with cleaning solution and then with boiling water. Screw caps are better than corks or plugs. After filling the bottles with the medium the caps are screwed half way down and the bottles auto-claved at 15 lb. pressure for 15 minutes. Upon removal from the auto-clave the bottle are cooled down by a slow process. This can best be secured by protecting the bottles from the wind current with a sheet of paper used as a screen. Otherwise there may be rapid cooling and the water vapour inside the bottle may condense down into water which might seriously affect the consistency of the medium. The medium may not set even after cooling. As regard the disinfection of the seed prior to the excision of the embryo, calcium hypochlorite method of Wilson has been in use for a long time 10 grms. of calcium hypochlorite is throughly shaken with 140 c.c. of distilled water and the clear liquid decanted. The seed is kept in this solution without bad effect for 3 minutes or more. Keeping for 5 minutes in a 2% chlorine solution has also been a standard practice.

The embryo-culture technique has now been greately simplified and standardised (Randolph, 1945). Any well lighted room reasonably free of the spores of moulds and bacteria is suitable for the transfer of embryos from the seeds to the culture bottles. The possibility of contamination from the air-borne spores may be reduced

considerably by spraying the table and the walls of the room with a 1% aqueous solution of phenol to which a few drops of a wetting agent such as Turgitol has been added.

For excising embryos out of mature seeds, the seed is sterilised in hypochlorite solution and then soaked in distilled water for 3 or 4 days according to the hardness of the seed with a daily change of water. Before excision the seed is dipped in 70% ethenol. Similarly all the instruments used in the operation and also the finger tips are dipped in this solution. The needle is then taken by a single passage through the flame of an alchohol lamp and then dipped in S. T. 37 (Hexyl-resorcinol) diluted 1 : 1 with distilled water. The embryo is like-wise dipped in this solution before taking to the medium.

The embryos are cultured first in darkness at 28 – 30°C. for 3 – 5 days and then transferred to weak day-light for another 3 or 5 days. There after the culture bottles are removed to the green-house from which direct sun light is avoided and in which the temperature is maintained at 65 – 85°F. After 2 or 3 weeks when the roots have developed, these are transferred to pots containing sterilised soil.

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A short resume of crop and plant protection, entomology-its past, present and future *

By

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Out of the seven lakhs of insect species estimated to exist in the world, about 10,000 are known to affect plant life. Of these about 500 species of insects are major pests affecting cultivated crops. As far as South India is concerned, nearly 600 insect species have been recorded as having a close relationship with cultivated plants and among these about 200 species are pests. It is with this number that the Crop and Plant Protection Officer (Entomology) has to tackle and devise remedial measures that would satisfy the agriculturist and horticulturist.

* Abstract of paper presented at the 32nd College Day and Conference.

The problem of the control of crop pests had been engaging the attention of a number of eminent workers, like Fletcher, Ramakrishna Ayyar and Ramachandra Rao, even from the early days of the Agricultural Research Institute at Coimbatore, but it was only in recent years--when under the stress of war and famine conditions, the Government itself had to become a stockist of food grains, that the importance of entomology has been adequately recognised.

It is estimated that about 10% of every crop is lost on the average through insect attack in the field and another 5% when the produce is in storage. Thus an agriculturist has to lose nearly 15% of his hard-earned grain on account of insect damage. It is also an undeniable fact that when a serious pest like the red hairy caterpillar or paddy grass hopper devastates large areas, there is a corresponding increase in rural indebtedness in the succeeding years.

In our desperate search for making up the food deficit and stop all imports of food grains by 1951, it has been calculated that if all the pests and diseases of crops in India are effectively controlled, there would be no need for us to go to other countries with a begging bowl. It is however needless to add that for the workers themselves in the Crop and Plant Protection Service it is proving to be a very trying time-to rise up to the expectations and demands of the public. It is not always realised that problems can seldom be solved overnight or merely by posting the personnel. The officer and his assistants can by themseves do little, unless there is also available, all the other accessories, such as effective insecticides, efficient appliances and a trained staff. It is perhaps very fortunate that the need for large-scale crop protection has come at a time when a number of very potent insecticides are available in the market. We have now sufficient stocks of all the necessary insecticides like Gammexane, Zinc phosphide, Agrocide and Geusarols at the taluk depots, with reserve stocks at headquarters. It is gratifying to note that the plant protection service has acquitted itself very well already. The paddy growers of Gudivada taluk in Krishna district who were hitherto feeling they had hardly any thing to learn from the Agricultural Department, have openly expressed their opinion now that it is in our Crop Protection Service that they realise the usefulness of the Agricultural Department as it has rescued them from the depredations of grasshoppers and rats, against which they were hitherto helpless.

There is however, considerable scope for improving the Crop and Plant Protection Service. The following are a few suggestions that would help in making the service more effective and more useful to the general public.

1. The strength of the plant protection staff has to be increased in districts like Krishna where extensive work is to be done.

2. The staff must be properly equipped with speedy transport vehicles, proper camping requistes, spraying and dusting appliance.

3. Adequate stocks of chemicals and insecticides have to be built up and kept in strategic centres where from they could be obtained at short notice whenever they are needed anywhere in a particular district.

4. A large amount of publicity is also very desirable to keep the activities and the service rendered by the Plant Protection staff always in the public eye. This would help in a better and greater use being made of the Plant Protection Staff, by farmers, to their better advantage.

Potato tops and sprouts as seed

By

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Under the stress of wartime and postwar food shortages, new methods of growing potatoes without impairing yields are being explored in various parts of the world, at the Nanjanad Potato Station too, attempts have been made to reduce the seed rate of potatoes by making use of tuber tips and sprouts as planting material. The sprouts were removed from uniform seed tubers and planted in a nursery under shade with 2″ spacing. These sprouts were transferred from the nursery to the main field 3 weeks later. On the same day as these sprouts were planted in the nursery, seed tubers with sprouts intact and seed tubers with sprouts removed were planted in the main field. For tuber tips, uniform tubers weigning 2 ounces were taken and tips weighing half an ounce were cut from the crown ends. These were spread over moist gunnies for 48 hours for suberization after which fine sulphur was dusted

on the cut surfaces and the cut pieces kept on wooden racks for sprouting. These were compared with half ounce, one ounce and two ounce whole tubers (the variety used was Great Scot in all treatments).

The experiment was continued for nearly five years from 1944 to 1948 and the following are the conclusions from the data from these experiments:

The method of using sprouts for planting cannot be recommended in the Nilgiris, although Puskarnath * obtained "Good yields" from sprouts in Simla and even recommended this method for rapid multiplication of varieties. Under Nanjanad conditions constant attention and frequent irrigation were found essential. Under drought conditions sprouts are a failure. During the main crop and the irrigated crop seasons fair yields are obtained but they are uneconomical. Yields from tips were found to be always lower than those from whole tubers weighing two ounces. From a number of experiments extending over a period of five years, it is proved that 2 oz. tubers give the maximum economic yields.

It may therefore be concluded that neither sprouts nor tips are capable of being used in place of the usual method of using 2 oz. whole tubers in the Nilgiris. Fair yields can of course be secured, but for large scale planting by ryots, the methods are not suitable as the returns are uneconomical.

Some aspects of the fodder problem in the Madras Presidency †

By

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India is primarily an agricultural country, where cattle form the backbone of agriculture, both as prime movers for all farming operations and as suppliers of milk and manure. In recent years, the food problem in India has assumed serious proportions; but in fact the fodder problem is even more grave. Our deficit in fodder is over 100% and production must be more than doubled if our

* Pushkarnath 1945. Current Science, 14 : 236–237.

† Abstract of paper presented at the 32nd College Day and Conference.

livestock is to be fed adequately Various views have been put forward to explain this fodder scarcity : one of which is that we are having too many useless animals that should be slaughtered forthwith. The real reason seems to be the lack of attentions that heifer calves get during the growing stages as compared with bull calves and the consequent slow growth and late bearing of such underfed animals. As a result of this chronic poor feeding, a needlessly large stock of cows have to be maintained to secure the necessary number of work bullocks. Under proper management with more liberal feeding, there would be no need to carry such a large stock of cow population.

The chief sources from which our fodder supply could be increased are (1) Forest grazing, (2) Grazing in Poramboke and waste lands, (3) private patta grazing lands and (4) fodders and crop residues from agricultural lands.

To improve grazing in forest areas, rotational grazing is necessary to give time for the grass to regenerate. Restricting the number of grazing cattle to the carrying capacity of the pastures and reseeding with nutritive fodder grasses and legumes are other means of which a rapid improvement can be effected. On porambokes and wasteland areas overgrazing is even more rampant and here it is essential that stringent control should be exercised in the matter of grazing, along with adopting such soil and water conservation measures as are necessary and reseeding over-grazed areas with suitable grasses and legumes. Private patta lands that are set apart exclusively for grazing are very limited in area ; being found only in the important cattle breeding tracts of Ongole and Kandukur where the Ongole breed of cattle is reared and the Dharapuram-Palladam tract for the Kangayam breed of cattle. The grazing in these areas is generally good, though even here in recent years, much of the pasture area have been broken up for cultivation. There is plenty of scope for improving these pastures by introducing more nutritious grasses and legumes.

Fodder from cultivated lands: In our province, more than 93% of cattle depend on agricultural land for their fodder and only some 7% resort to forest grazing. Crop residues such as straws of cereal crops, haulms and bhusa of pulse crops etc., form the chief sources of fodder. The position at present is such that even if an increase of 50% is secured in straw yields by adopting intensive methods of cultivation, we are still faced with a huge deficit of 20

million tons of dry roughage per year. It is here that we have to examine the scope of mixed farming as a possible solution. In a mixed farming system, the farmer grows all the fodder that is needed for his livestock, on his own land. The manure obtained from his livestock is returned to the fields year after year and thus the fertility of the soil is maintained at a high level and crop yields increased. The results obtained in mixed farming experiments both in India and abroad, have shown that mixed farming is the only way to bring back the fertility of soils and secure high yields of grain and straw. A healthy relationship between animal, plant and soil is essential for success in farming and mixed farming is the only lasting solution for maintaining this relationship and solve our urgent food and fodder problems.

Some useful plants for green manure purposes, for the saline tracts of the Presidency

By

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"GROW MORE FOOD" is the slogan which we hear everywhere now, partly due to the after effects of World War II and partly due to the shortage of food crops on account of the ever-increasing population. India is passing through a critical period with regard to her food problem. India's production of food crops has not yet reached a level so as to be reckoned as self-sufficient. To keep pace with the rapidly increasing population, there should be a corresponding augmentation in production. The countries from which she was getting her food supplies, especially rice, from Burma, Siam etc., to meet her deficit, have also suffered during war and countries all over the world are not happy to ensure imports. There is besides, economic considerations, and we cannot be indefinitely importing. With the available cultivable lands, we are faced with problems of increasing food production by adopting all possible ways and means. Among the various methods suggested, the problem of manuring the fields has to be given a very prominent place in this work as it is a well known fact that our lands are impoverished.

Among the food crops of our Province, rice occupies a pre-eminent place as it forms the staple food for the majority of the population. The present area under rice is about 11 million acres and it forms the largest acreage of any one food crop of our Province. Rice is cultivated under a variety of conditions namely, dry, semi-dry and wet; there are again the alkaline or saline lands and those irrigated by fresh water. To suit the various conditions of rice culture one has to select a suitable manure. For the wet cultivation of rice, green leaf manure has been proved to be the best. The green leaf is either obtained by loppings of trees and shrubs or by raising green manure crops in the field and ploughing them "in situ". Trees and shrubs will be available in plenty only near forest areas but near the sea coasts or in the deltas, a crop has to be grown for green manure purposes. Most of the green manure plants come up well in good soils in fresh water; but regarding alkaline or saline soils the problem of growing suitable plants that will withstand the salinity has to be considered. For the delta areas many green manure plants are cultivated such as Sunnhemp, Daincha. Kolinji, Pillipesara etc., but there are vast paddy areas near the coast or adjoining the back-waters, as in the West Coast, where saline conditions do require some special plants which will withstand salinity.

To have some idea of the saline lands, a short introduction regarding their situation may not be out of place. The Back-waters or 'Salt lagoons' are quite common on the West Coast while in the East Coast they are more or less confined to the estuaries of big rivers like Godavari and Kishna. On the West Coast of our Presidency the broken nature of the country has brought about innumerable rivers and on account of heavy rainfall the volume of water carried by them is very great at times and the tidal influence is felt for many miles in the interior, especially during the summer when sea water freely flows into the river and this naturally renders the rice fields adjoining the back-waters saline.

In Malabar, 'the back-waters' and 'salt-marshes' are confined to the taluks of Chirakkal, Tellicherry, Calicut and Ponnani. In Chirakkal, the Baliapatnam river is one of the biggest and tidal influence is felt to a pretty long distance in the interior but the coconut gardens occupy the very edge of water for a fairly long distance, with scattered rice fields; similarly the Feroke river which is also saline, has coconut gardens almost up to the water edge. The salt-marshes near about Tellicherry, Badagara, Calicut and

the surroundings can be planted with any of the useful plants given below instead of the present vegetation which mainly consists of *Acanthus ilicifolius* L. This plant is spinescent all over and forms impenetrable bushes all over the marshy areas very rapidly, and if left unchecked, in several places it blocks irrigation channels and canals and is as big a menace as the Water Hyacinth in Bengal; this plant is unfit for any use. In Ponnani taluk salt marshes are abundant on either side of the Canolly canal and especially the area between the sea and canal towards the coast; towards the coast the canal is intercepted by several arms of back-waters which form the net work of canals near about Chawghat and Chetwayi. In this one comes across large areas of paddy fields, which are necessarily alkaline or saline on account of their proximity to back-waters. For these fields, the leguminous crops dealt with in this note will be of great use. In the South Canara district there are six principal rivers, namely Netravati, Gangolly, Sita nadi, Swarna nadi and Chandragiri, the back-waters or salt marshes formed by these rivers are met with in Kasargod, Mangalore, Udipi and Coondapur taluks. Of these the biggest back-water area is met with in Coondapur, where the Gangoolly river which is formed by the confluence of the waters of 'Kollur and Haladi rivers' joins the sea, resulting in an extensive back-water area. During the summer months, on account of the free onrush of tidal waves, salinity is felt several miles to the interior. Here we meet with typical forests of mangrove trees on either side of the rivers. These mangrove plants are specially adapted for saline or salt marsh areas and some of them grow to medium sized trees and are useful in preventing soil erosion of the banks. These trees produce abundant quantities of leaves and these can be readily used for manuring the rice fields adjoining these rivers. Mangrove plants particularly *Rhizophora mucronata* which grows to good dimensions in these tracts, may be used in planting the sides of the big rivers like Netravati, Baliapatnam, Feroke etc. When properly attended to, and pruned regularly, these plants are never a menace to the rivers; rows of these plants may conveniently occupy about 10 to 15 feet on each ride of the river. As already pointed out the salt marsh tracts of Tellichery, Badagara and other places which are now foul with *Acanthus ilicifolious* and other useless plants may be usefully planted with one of the mangrove trees listed below, for green manure purposes.

The following are some of the plants recommended for planting along the sides of back-waters.

1. ***Rhizophora Mucronata, Lamk*** (Rhizophoraceae). This plant is known in Tamil as Kandal, in Telugu, as *Upoo-pooma.* This is an ever-green tree often appearing buttressed by the mud being washed away from the branching aerial roots, the lower part of the stem dying off. The bark is a valuable tanning material, wood is dark red, very hard and an excellent fuel. ***Propagation :*** The fruits are viviparous and as soon as they fall from the trees on the miry soil, strike root.

2. *Kandelia Rheedii W & A.* (Rhizophoraceae) A small tree: bark reddish brown; used only for fire-wood; Telugu - Thuvar kandan.

3. *Bruguiera Conjugata,* Merr (Rhizophoraceae). A large ever-green tree; wood red, extremely hard, used for building and for fuel. Telugu-Thudda Ponna. Hindi : Kankara.

4. *Excoccaria Agallocha, Linn* (Euphorbiacea). An ever-green tree with a poisonous milky juice, bark grey, shining, wood white very soft. Telugu-Thilla; Tamil-Tilai - Malayalam : Komatti.

5. *Dolichandrone Spathacea* K. Schum (Bignoniaceae). A moderate sized deciduos tree common on the blanks of rivers and back-waters. Wood, white soft. Tamil-Vilpadri; Malayalam -Nirpongilium.

6. *Derris Uliginosa :* (Papilionacae). A large ever-green climing shrub with rose coloured flowers and rather large leaflets. It occurs in the sea coast forests and tidal river banks on both sides of the Peninsula; it is found climbing over trees growing along muddy salt water creeks. The leaves are poisonous and not relished by cattle; along with loppings of tress these may be also pruned. This flowers in August and September and the seeds are available from November onwards.

II. Plants recommended for the sand banks: A little away from the sea water front:

Morinda Citrifolia, Lin: (Rubicaeae) Tamil: Nuna; Malayalam-Manhanathi; Telugu-Sira Njikadai; occurs in the coastal forests of North Circars and West Coast: cultivated widely in many places throughout India. The roots furnish a valuable red dye. The fruits are cooked when unripe and eaten when ripe. This was found growing along sand banks adjoining the back-waters of Udipi. It is a medium sized tree producing broad leaves in plenty

Scaevola frutescens, Krause (Goodeniaceae) Marathi: (Bhadrak). It occurs in the West Coast near the sea; found near the water-edge of the back water, very close to the sea near Malpi. A large shrub with large fleshy leaves, white flowers in axillary cymes and a white somewhat lobed droupe. Found also near the sea shores of India from Sind to Ceylon. It is stated that the juice of the berries were used for clearing off opacities in the eyes and to take away dimness of vision. Leaves are eaten as a vegetable (Watt).

Pavetta indica L. (Rubiaceae) (Hindi : Kankro). A small sized tree with white flowers found growing along the sand banks at the junction of the sea and back water near Nileshwar and Kasargod; the root and leaves are used as medicine by Ayurvedic doctors (Watt). The fruit is eaten in some parts of Madras (Watt).

III. Leguminous plants recommended for saline rice fields.

Crotalaria striata: (Papilionaceae) (Tel.-Munga). A tall herb growing upto a height of 2 or 3 feet occurs in low lying areas and sandy tracts; it was also found to occur under extreme saline conditions namely on the sea sand near the junction of back water and sea, near Nileshwar. This is cultivated on a large scale in Nileshwar coconut farm, and seeds may be available there.

Crotalaria Verrucosa: (Papilionaceae) (Tamil: Vuttei Khilloo) (Tel.-Ghele gherumta). It occurs under a variety of conditions, namely Nilgiris, Cuddapah and sandy belts near the sea coasts. This is recorded along both the sea coasts. This is found growing very near the reach of tidal waves also. Grows to a height of 2 to 3 feet; much branched undershrubs with blue flowers. Propagation by seed.

Rothia trifoliata Pis. (Papilionaceae) T: Nurrey pittan keeray; Tel: (Nucka Kura). A much branched and spreading annual, spreads to a radius of 1 to 1½ feet. Leaves and pods are boiled and eaten as a vegetable in times of famine. (Flowers in September and October).

Research Notes

Viability of ragi seeds (Eleusine coracana): In Vissakhapatnam district, in wetlands it is customary to grow a crop of ragi (early) in May — August season preceding the main paddy crop and another crop (late) in December — April, succeeding the paddy crop. At the Sugarcane Research Station, Anakapalli in 1945 — 1946 certain fields were cropped with early ragi. These fields were planted to paddy and after its harvest the land was prepared to take in the late ragi. Soon after these operations the fields were found to be covered with ragi seedlings. These could not have been due to seeds carried in the manure since other fields manured from the same heap were entirely free from ragi seedlings. The only source then was from the early ragi preceding the paddy. It was however, doubtful whether the ragi seeds shed in field could live through the puddled submerged condition prevailing during the period of the paddy crop.

To verify these observations pot experiments were conducted simulating the conditions in field. Six small pots with soil from wetlands were sown each with 200 seeds collected from the late ragi and soil throughly raked up. The pots were watered and the level of water maintained at 2" over the soil, for a period of four and half months to correspond to the duration of the paddy crop. The soils from the small pots were transfered to bigger pots with similar soil, throughly raked and allowed to dry up completely in the sun. After four days of drying the pots were watered to give optimum conditions for germination and the germination counts taken. This experiment was repeated between 2—9—1946 to 20—12—1946. The results are summarised below. In all cases 200 seeds were sown :

Pots Nos	Periods of investigation			
	10—4—1946 to 31—8—1946		2—9—1946 to 20—12—1946	
	No. seeds germinated	Per centage of gemination	No. seeds germinated	Per centage of germination
1	43	22	76	38
2	72	36	108	54
3	38	19	68	34
4	48	24	121	61
5	31	16	103	54
6	36	18	49	25
Average	44·6	22·5	87·5	44·3

A third experiment avoiding all possibilities of seed contamination from field and manure was conducted by placing the freshly harvested seed immersed in water in a glass bottle. Daily changes of water were given. The experiment was started on 2—9—1946. The seeds were removed from the bottle on 26—12—1946 and sun-dried till they became hard. The per centage of germination were found to be : set I = 79 ; set II = 84. It was thus proved that ragi seeds retain their viability under paddy land conditions at least for four months. It is therefore not safe to grow, especially, ragi crop meant for seed purposes in a field previously cropped with early ragi.

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B. L. NARASIMHAMURTY,
Millet Assistant.

Gleanings

Observations on human behaviour in experimental semi-starvation and rehabilitation. Franklin, J.C., Schiele, B.C., Brozek, J., and Keys, A. In contrast to the disapperance of hunger said to occur in total starvation, the semi-starved subjects were always hungry, though some suffered more than others. Desire for dietary variety was very strong at times, but was always subordinated to a craving for bulk. Food became the dominating factor in thought and action. Eating habits showed a possessive attitude, subjects hovering closly over their trays and eating silently and deliberately, with intense concentration. Every particle of food was consumed, and dishes were licked. Many men showed fantastic ingenuity in making food last, and in developing new ways of modifying dishes as served. Fluid intake rose so markedly that a limit of 9 cups of coffee daily was imposed; even so, many subjects brewed the strongest possible cups and increased the volume by dilution, or consumed the liquid portion of soup and then repeatedly added water to the solid residue. There was little tolerance or humour towards matters concerning food. Waste became a major crime, and lack of "seriousness" on the part of cooks and servers caused much irritation.

Emotional instability resulted from the stress, apathy being very marked except in relation to food and the experimental life, about which all interest tended to narrow. Irritability increased untill it became an individual and group problem. Nervous tension was revealed also by increase of such habits as nail-biting, gum-chewing and smoking. Personal appearance was neglected though bathing remained popular since it provided warmth. Humour "dried up", and the tone of the group became sober and serious, apart from the exhibition of irony and sarcasm. Curious forms of acquisitive behaviour presumably compensated for food deprivation. Useless articles were bought and stored up, and the collection of food recipes became a fad. Intelligence, as tested, appeared to remain at its normal level; men often believed they had suffered intellectual deterioration, but this was due to narrowing of interests, apathy, and lack of initiative in conversation and study. During rehabilitation, energy and physical well-being increased roughly in proportion to caloric intake. Recovery from dizziness, apathy and lethargy was rapid, but tiredness, loss of sex drive, and weakness were slow to improve. Appetites remained insatiable for a long time, and habits such as plate licking and "toying" with food persisted. Many men became more depressed and irritable through a sense of disappointment at the failure of the expected "new lease of life" to materialise quickly. But discontent and aggressiveness replaced apathy and aquiescence, and gradually physical, social and cultural interests reappeared.

After 12 weeks of rehabilitation, 12 men remained under observation, but were allowed to eat as much as they liked at weekends. During these 2-day periods they ate more or less continuously, consuming 6,000 to 7,000 cal. daily. Manipulation of menus, licking of plates and intolerance of waste (despite obvious abundance) were still very noticeable. In general, the men ate more than they should have, and there were many instances of sleepiness and gastro-intestinal upset. (J. Clin Psychol 1948, 4, 28—45. (Lab. physiol, Hyg. Univ. Minnesota). T. R. N.

Coir dust or cocopeat-A by-product of the coconut—*E.P. Hume:* During the separation of coconut fiber by machinery some very short fibres unsuited for cordage but well suited for manufacture of the door mats are produced. A by-product of the latter industry is a mass of tiny, brown, irregularly shaped, particles known as 'Coirdust'. Since the term 'dust' is misleading and the possibility of using this by-product in horticulture, the author has suggested instead the name 'coco-peat'. The meagre literatures chiefly from India and Ceylon dealing on this substance, recommend its use as a material for increasing organic matter in horticulture, as manure direct

or as material to absorb the cattle urine and a bedding for stock. Its slow decomposition has also been noted. Only one author has dealt with its chemical aspect as fertiliser. He has shown that it has less than 1% of any major nutrient and is unfit as fertiliser and that its slow decomposition is due to its low pentosan lignin ratio (40% lignin : 12% pentosan). Its decomposition is hastened if materials like grass are increased. By adding even small quantities to sandy soils their moisture content is increased from 24 to 33·2%. By itself the dust can retain over 80% water on dry weight basis. A recent chemical analysis of this dust done in the U. S. A., is as follows :—

Mineral composition of 3 fresh samples of unscreened cocopeat.

Sample.	Ash. %	Ca. %	Mg. %	K. %	P. %	N. %
1.	2·39	0·42	0·63	0·82	0·07	0·11
2.	2·45	0·39	0·70	0·25	0·09	0·11
3.	2·48	0·31	0·65	0·84	0·02	0·11

A four year old, well-weathered sample also showed extremely little decomposition. It is fairly rich in iron and manganese (17 P. P. M. water-soluble manganese, 33 P. P. M. of exchangeable and 63 P. P. M. of reducible manganese; iron, 100 P. P. M. water-soluble, 78 P. P. M. exchangeable and 81 P. P. M. reducible iron.); slightly acid with a P.H. value of 5·7 to 6·7. Cocopeat is slow in decomposition, hence requires less frequent replenishing than other mulching materials and is generrally mixed with soil by action of earthworms etc., eventually improving the soil. It has been found that cocopeat is not toxic but on the other hand stimulative to growth. The only difficulty with cocopeat as a mulching material is its light weight when dry. This could be easily overcome by preventing surface waterflow and also by a light dressing of sand on the top. This has a great advantage in being free of weed seeds. Cocopeat while conserving moisture in the soil also allows rapid penetration of even a small shower of rain. Mixed with heavy soil it improves its physical condition making it porous, and facilitating drainage and aeration. Mixed with sandy soil even in small percentage, the moisture content is improved. In top mulching of clay subsoil the cocopeat absorbs and holds most of the water and allows its penetration slowly. Cocopeat is also useful in propagating seeds and cuttings. It is best used mixed with equal parts of sand and compost. It's further use in horticulture has to be investigated. (Economic Botany 1942, Vol. 3, P. 42—48). N. K.

How Britain Plans to Raise Farm Production

20 per cent. increase by 1952

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The recent appeal to the nation by the Prime Minister of India, Pandit Nehru, for a concerted drive to tackle the food problem by producing 15 per cent more and becoming self-sufficient in food by 1951 finds a parallel in Britain. Farmers there have been asked by the Government to raise agricultural output by 20 per cent, by 1951-52. In the article below the author points out how they are planning to reach the target.

Although formers in Britain produce only for the home market they cannot, on the limited land available, grow enough food to feed a population of 50,000,000. In the year 1948-49, 49 per cent of her total food supplies, measured in protein, was imported and in terms of calories, 63 per cent.

When imports were severely cut during World War II because of shipping difficulties, the farmers of Britain made great efforts to fill the gap. Today even more food is called for, because the country can only afford imports to an amount which can be paid for by exports. The farmers, by growing more per acre, can help to save foreign currency so that enough is left to buy the raw materials which are indispensable to the industries which make goods for export and the home market.

The Government has asked farmers for a net output per acre in 1951 52, 20 per cent, higher than that of 1946-47. Wheat, eggs and pig meat are especially emphasized in this expansion programme, details of which are known throughout the farming community.

Advisory Services. Some part of the increased production will be achieved by better use of existing resources as technical knowledge spreads and less efficient farms are brought up towards the level of the best. The Government has set up advisory services to assist farmers and estate managers to make use of recent discoveries and new methods.

It is fully recognised, however, that if farmers lack the necessary resources they cannot raise the output. Land itself is much in demand for other uses besides agriculture, and although some reclamation and improvement of waste land will be possible, no extension of the total farm area can be hoped for. The present labour force is expected to be adequate, though it will still be necessary to find extra help at the busiest times.

The chief need is for equipment and supplies which will make labour more productive. More machinery, fertilizers and other supplies will have to be brought on to the farms, new farm buildings must be built, and old ones renovated and improved. Agriculture has to compete whith many other industries for steel, timber and other materials used in construction and manufacture. The Government attempts to allocate supplies in proportion to the urgency of the various needs Over the four years ending in 1952-53, £450,000,000 (Rs. 600, crores) will be spent on capital equipment for agriculture. Most of the money must come from farmers or landowners themselves.

Tenant Farmers. Over 60 per cent. of farm land in the United Kingdom is not owned by the farmers who occupy it. They pay an annual rent to the landowner. In return the owner has to provide all the fixed equipment (such as farm buildings roads, fences, drains, and water supplies) which are necessary for efficient farming He must keep this equipment in good repair and carry out such alterations and improvements as are needed. These obligations are laid down in the Agriculture Act of 1947, and failure to observe them may result in supervision, direction and even dispossession of the landowner. The long-term programme provides £ 24,000,000 (Rs. 32 crores) to be invested by private landowners in 1949, and this should rise to £ 30,000,000 (Rs. 40 crores) in 1951. New farm buildings—cow sheds, machine sheds, Dutch barns, and so on — will take up most of this expenditure, but many owners are also planning to build or repair farm-houses and cottages, and to improve drainage and the supply of water and electricity. New works actually undertaken in 1948 showed that owners were measuring up well to their part. Arrears of maintenance work are being wiped out. Rents are adjusted to include payment of interest on these improvements, for most landowners cannot finance the investment out of income. The £. 24.000,000 represents over half the total annual rent and is, of course, additional to normal expenses of management. Owners, therefore, have to borrow or draw on their capital. Bank advances for agricultural development have substantially increased in recent years.

Increased Mechanisation. Farmers, on their part, have to provide the working capital which the programme demands. Over the next four years they will require new machinery and replacements costing about £. 50,000,000 (Rs. 66·67 crores) a year. Many tractors have been bought since 1939, though even at that time there were 60,000 in the U.K., or one to every 220 acres of arable land. Nearly all farms having 30 acres or more of arable land are now equipped with a tractor ; most farms of over 200 acres have two ; and it is quite usual to find three or four tractors, as well as five or six horses, on arable farms of 300 acres or more.

There is now almost enough power-driven machinery to carry out the increased cropping plans, and the present total of 260,000 tractors will not be incroasd beyond 300,000 during the four-years period. Purchases will mainly be replacements.

More than half the agricultural tractors in use in countries receiving Marshall Aid are in the United Kingdom. The other contries are pressing on with mechanisation. Norway, Sweden, Denmark, Switzerland, Ireland and Turkey all plan to have at least 20 per cent. more machanisation in agriculture in 1950-51 than they had before the war. Mechanisation in the U. K. will make a major contribution to the increase in output per worker. The range of impenements on the farm is continually widening. To handle the extra acreage of grain, 11,000 combine harvesters should be available in 1950, compared with 6,500 in 1948. New types of machines to deal with labour-costly root crops (especially potatoes and sugar beet) are expected to be brought in ever increasing numbers ; while the compaign for extending the practice of grass drying should result in the use of at least 1,500 driers in 1950.

Price Fixation. Grass is still potentially Britain's richest crop, but farmers must buy at least 20 per cent more fertilizers and use a large part of this on pasture land. This will provide more feed for cattle, but increased quantities of imported feedingstuffs will have to be bought to establish and maintain much larger populations of pigs and poultry which are to be kept.

The cost of all these machines and supplies has been kept in mind by the Government when fixing the future prices which formers will receive for their produce. These prices have been designed to allow a margin above the normal cost of production and sufficiently wide to enable farmers to meet the additional investment. Figures given by the Economic Commission for Europe show that in 1948 four per cent. of the gross investment in fixed capital in the United Kingdom took place in agriculture. In most contries of Europe, remarks the Commission, "the share of agriculture in total investment was not at all commensurate with the importance of agriculture in the national economy". Net investment in agriculture (excluding repairs and maintenance) was actually negative in some countries (such as Czechoslovakia and Bulgaria), but the figures may conceal an increase in numbers of livestock being carried. France and the United Kingdom, however, are singled out as showing "adequate appreciation in their plans of the importance of agricultural investment." (British Information Services.)

ERRATTA.

Vol. XXXVI No. 11.

1. **Page** 509 — Statement of Acidity lists — under "Butter" — item 3 (against 8 days storage) — last column (under Butter milk) — *for 0·0937 substitute 0·1471.* **(The same figure 0·0937 is repeated twice. The first is correct, but the 2nd is wrong, which has to be corrected).**

2. **Page 510 — Line 31 —** ***for 9·0536 substitute 0·0536.***

3. **Page 510 — Lines 38 and 39 —** ***delete "flaccid at the end"*** (This not mentioned in the original).

Agricultural News Letter

Sea Island Cotton in West Coast: Cotton stands transplanting and cut stems root freely. This is revealed by trials at Mangalore, Nileshwar and Pattambi. The cuttings and seedlings establish better when transplanted on rainy days. No difference between the seed-planted and transplanted plants was seen in growth.

Vellai Cholam: Two new strains of Vellai Cholam, evolved at the Millet Breeding Station, Coimbatore, bearing the station number Co. 12 and Co. 13, have recently been released to the cultivators. Strain Co. 12 is a selection from a variety of Uppam or Mottaivellai cholam of Palladam taluk of Coimbatore district. This high yielding strain is of special importance at the present period of food crisis and it also satisfies the long-felt need for a strain of very short duration among the irrigated Vellai cholams. It matures in 85 to 90 days and can be grown in January to April and March to June seasons. This strain has a compact panicle, red glumes and bold chalky white grain. Its short duration is a great asset and it is bound to be popular in areas of limited water resources and also in places where intensive cultivation is practised. This strain has already undergone a series of trials, both at the Millet Breeding Station and in the districts. Its performance has been uniformly good in all the centres of trial. Co. 12 was earlier than the local types by two weeks in Tinnevelly district and yielded 19 to 100% more grain than the local. Reports of high yields, ranging from 15 to 56% more grain than the local were received from Coimbatore, Tiruchirapalli and Chittoor districts also.

The strain Co.13 originated from another irrigated variety called Ennaivellai Cholam of Gobichettipalayam. It is similar to cholam strain Co. 8 in respect of yield and duration; but differs from it in having bolder grains. This strain meets the demand for a high-yielding strain of Vellai cholam, having a bold grain and a duration of 105 days. It has been tried at the Millet Breeding Station for several years, and high yields exceeding 3,000 lb. per acre have been recorded. In district trials, it was found to be superior to the local types of Gobichettipalayam, giving 15% increased yield of grain. It is proposed to extend the trials of these new strains to other centres of irrigated cholam. Arrangements are being made to multiply the strain at Coimbatore, with a view to supply nucleus seed to bonafide cultivators, who agree to try this in systematic trials, and grow them under seed farm conditions. Cultivators, who wish to try these new strains, are requested to write to the Millet Specialist, Lawley Road P. O. or the Local Agricultural Officers for their requirements.

Control of Millets Grasshopper Pest: The millets grasshopper was found occurring as a pest in Rajampeta and Vontimetta areas of Cuddapah district for the last three years. This grasshopper pest not only badly defoliates the cumbu, cholam and tenai sown in the month of June but even attacks the earheads and makes them empty. In the occurrence of this pest in the course of 1948, the fields were left bare in some of the areas and there was nothing left for the ryots to reap. The fodder for cattle was also lost.

Control measures: It is necessary that these grasshoppers should be destroyed while still young with green colour and before they become adults with wings. In so destroying the pest, we not only save the crop of the present year but even prevent the pest from laying eggs and carrying itself to the next generation in the following year. For the destruction of the pest in the field, Gammexane D ·025 dusting at the rate of 20 to 25 lb. per acre had given spectacular and effective results in the campaign in Cuddapah district. In a short time after dusting, we find the

young hoppers falling down to the ground in numbers. The insecticide is kept in stock in all the Agricultural Departmental depots for sale to ryots. For use with food crops, pulses, vegetables, and root crops, the Government charges the ryot only half the cost plus incidental charges as a concession to encourage the savings of these crops from insect pests and disease. At this concession rate for dusting cumbu, cholam and tenai crops, it costs about Rs. 4/- per acre and since the average yield per acre of these irrigated crops in the area is 1,500 lbs. per acre, a ryot is sure to save at least half of this, costing Rs. 100/-. There is advantage in killing the pest in its early stage of 'young hoppers'. The planted fields, nurseries, left overs in nurseries and grassy patches round the fields will have to be dusted with Gammexane. Dusting can be done by splashing the insecticide with hand and the Agricultural Department has also some dusters for supply to ryots. During the year 1949, a total area of nearly 1,700 acres in Rajampeta and Vontimetta areas was dusted with Gammexane, ridding these areas of this pest. There was considerable response from the villagers in the areas in adopting the control measure and the relief afforded by the treatment was fully availed of. It is hoped that the ryots in other places, where they have thir pest, would report its occurrence to the Agricultural Department and save their crops from this bad pest of cereals.

Fungicide treatment of seeds: In recent years, seed-treatment before sowing has been accepted as a regular farm practice, in order to eliminate losses due to seed-borne diseases or soil-borne diseases, which affect the plants in the seedling stage. With the urgent need for greater food production, greater attention must be devoted to seed-treatment, in order to increase the stand and thereby increase the yield. Many seed-borne diseases are prevalent in our food crops, which will respond to seed-treatment. The foot-rot of rice and helminthosporios of rice are controlled by treating the grain with organomercury compounds like Agrosan GN or Ceresan. Grain smut of sorghum is easily checked by treating the seed with sulphur powder. Seed dresssing with Ceresan or spergon is very useful in preventing damping off and other diseases affecting tomatoes, peas and beans. Sweet potatoes are treated for protection against tuber-borne rots and some soil-borne fungi. Seed ginger is dipped in a dilute solution of mercuric chloride to prevent storage rot. These treatments are comparatively cheap. But some of the chemicals used are poisonous and the materials treated should be used only for sowing and not for food.

Ratooning of Sugarcane: Ratooning of sugarcane is becoming a common practice and many ryots ratoon their crop repeatedly three or four times or even more. Their main object in ratooning is to save the cost of preparatory cultivation and the cost of seed. But they generally neglect all the items of cultivation and are satisfied with whatever yield that could be got. This is not correct. Ratoons require more attention than plant crops because (a) the field had no preparatory cultivation and hence initial fertility is low; (b) cane after cane follows and hence there is no rest for the land. (c) there is possibility of carry-over of pests and diseases of previous crop; (d) ratoons are generally of poor vigour in growth in later stages. It is, therefore, essential to take particular care of the ratoons, in order to get higher yields and also to prevent rapid soil deterioration. The following are recommended for ratoons: (a) harvest the plant crop flush to the ground or even one to two inches below the ground; (b) disturb the ridges and furrows by working a light plough. (c) give a heavier dose of manure than to plant crop; (d) remore unthrifty plants by August - September; (e) pull out smutted clumps and burn them. (f) ratoons mature earlier and they may be harvested one or two months earlier than the corresponding plant crops. Ratoons of the different varieties are to be harvested first before plant crops in factory zones, to increase recovery percent.

Sugarcane for water-logged conditions: Sugarcane is generally grown in wet lands once in three years, in rotation with the paddy. Naturally, when sugarcane is preceded and succeeded by paddy, it is sourrounded by paddy crop on all sides, and consequently swampy conditions prevail for sugarcane also. But sugarcane comes up excellently in well-drained soils only and is not quite tolerant to bad drainage. Besides, in the areas adjoining tank-bunds and places, where the water table is high, drainage is inadequate, resulting in water-logged conditions in the fields. Most of the sugarcane varieties fail to thrive satisfactorily under the swamp conditions and it was found after a through experimentation at the Sugarcane Research Station, Anakapalle, that Co. 419 is the best variety for such conditions. It is better to plant the cane early i.e., by about the middle of February, so that the crop can make good growth before the advent of the monsoon. When the crop has grown up to some extent, it is able to resist the water-logged conditions better. Canes grown under water-logged conditions mature earlier i.e., by December-January and the recovery of jaggery per cent is more and the quality better. In a series of trials with different varieties conducted at this station, it is noted that Co. 419 is unrivalled in yield under swampy conditions, with an average yield of 38 tons of millable cane per acre, when planted early in February. This yield is less than that from a crop under normal conditions by about 5—8 tons, and this difference is compensated to a certain extent by higher recovery of better quality of jaggery and early harvest and marketing when prices are usually high. Hence Co. 419 is recommended for all soils liable for water-logging during the monsoon and it has to be planted about a month earlier than the normal.

Hybrid Cumbu Strains: Two hybrid strains of cumbu X. 1 and X. 2 evolved at the Millet Breeding Station, Coimbatore, have been found to be outstanding in their yield performance in the Coimbatore district. In trials, conducted at Ondipudur, both the hybrids were superior to the local cumbu. These strains X. 1 and X. 2 gave 1,296 lbs. and 1,200 lbs. of grain per acre respectively against an acre yield of 830 lbs. of the local type. The increases in yield were 56% over local in the case of X. 1 and 44·6% of X. 2. These hybrid strains have also done well in the Tiruchirapalli district and they are now being tried in the other districts of the Presidency.

Livestock improvement: Eighteen Murrah buffalo bulls and 17 Scindhi bulls were purchased from North India and distributed under the Livestock (bull) Distribution Scheme to the various districts in the Province, for the improvement of Livestock. Government have also sanctioned the opening of a District Livestock Farm in the Malabar district

Crop and Trade Reports

Statistics-Crop-Intermediate Condition-Report Madras Province 1949—50.

Gingelly. The gingelly crop has been affected by severe drought in Anantapur district and by insect pest in the district of Bellary during the period of its growth. The yield per acre is expected to be below normal in the districts of Guntur, Bellary, Anantapur, Chingleput and Malabar and normal in the other districts of the Province. The wholesale price of gingelly seed per imperial maund of 82 2/7 lb. as reported from important market centres on 5—11—1949 was Rs. 32—15—0 in Tirunelveli, Rs. 30—12—0 in Eluru, Rs. 30—10—0 in Visakhapatnam, Rs. 30—4—0 in Tiruchirapalli, Rs. 30—2—0 in Kakinada. Rs. 29—12—0 in Rajahmundry, Rs. 29-10-0 in Tuticorin, Rs. 29—5—0 in Cuddalore, Rs. 28—14—0 Visianagaram and Rs. 28—12—0

in Salem. When compared with the prices published in last report i.e., those which prevailed on 8—10—1949, these prices shown an increase of 9 per cent in Kakinada and 2 percent in Tuticorin, the prices remaining stationary in Tirunelveli, Eluru, Tiruchirapalli, Cuddalore, Vizianagaram and Salem.

Groundnut: The winter crop of groundnut has been affected by recent cyclonic rains in the districts of Krishna and Guntur, by want of timely rains in the districts of North Arcot and Coimbatore and by attack of insect pests in the districts of Bellary, Anantapur, Chingleput and Ramnad. The condition of the crop is generally satisfactory in the other districts of the Province. The wholesale price of groundnut (machine shelled) per imperial maund of 82 2/7 lbs. as reported from important market centres on 5—11—1949 was Rs. 30—4—0 in Cuddapah, Rs. 29—5—0 in Bellary, Rs. 28—11—0 in Tadpatri, Rs. 27—14—0 in Hindupur, Rs. 27—2—0 in Coimbatore, Rs. 26.—8—0 in Guntur, Rs. 26—6—0 in Guntakal Rs. 26—4—0 in Nandyal, 25-15-0 in Erode, Rs. 25—9—0 in Adoni, Rs. 25—2—0 in Vizianagaram, Rs. 24—13—0 in Salem, Rs. 24—3—0 in Cuddalore, and Rs. 23—4—0 in Vellore. When compared with the prices published in the last report i.e., those which prevailed on 8—10—1949, these prices reveal an increase of 21 percent in Coimbatore and a decrease of 17 percent in Guntur, 15 percent in Adoni, 13 percent in Cuddalore, 12 percent in Nandyal and 10 percent in Erode. The prices remained stationary in Cuddapah, Tadpatri and Hindupur.

Sugarcane: The condition of the sugarcane crop is generally satisfactory in all the districts of the Province except in Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur and Bellary. The crop has been affected by heavy rains in parts of Visakhapatnam, by cyclone in East Godavari, West Godavari, Krishna and Guntur and by lack of adequate supply of artificial manures in Bellary. The yield is expected to be below normal in the affected districts and nearly normal in the other districts of the Province. The wholesale price of jaggerry per imperial maund of 82 2/7 lbs. (equivalent to 3,200 totals) in the important market centres in the Province on 3rd December, 1949 was Rs. 31—13—0 in Adoni, Rs. 30—7—0 in Cuddalore, Rs. 29-6-0 in Mangalore, Rs. 28—0—0 in Salem, Rs. 26—12—0 in Bellary, Rs. 26—7—0 in Tiruchirapalli, Rs. 26—0—0 in Erode, Rs. 25—10—0 in Visakhapatnam, Rs- 21-6-0 in Kakinada and Rajahmundry, Rs. 20—9—0 in Vellore, Rs. 18—5—0 in Vizianagaram and Rs. 17—8—0 in Chittoor. When compared with the prices pubished in the last report i.e., those which prevailed on 5th November 1949, these prices reveal a rise of approximately 16 per cent in Cuddalore, 13 per cent in Vizianagaram, 9 per cent in Adoni and 3 per cent in Bellary and a fall of approximately 25 per cent in Erode, 24 per cent in Chittoor, 23 per cent in Rajahmundry, 16 per cent in Vellore. 13 percent in Visakhapatnam and 8 per cent in Kakinada, the prices remaining stationary in Salem, Tiruchirapalli and Mangalore.

Paddy: The harvest of the first crop of paddy is progressing in parts of the West Godavari and Chingleput districts and has either concluded or is concluding in the Central districts the South and the West Coast. The yield per acre is expected to be normal or nearly normal in the West Coast and the Nilgiris district, and below the normal in the districts of West Godavari, Chingleput, Coimbatore, Tiruchirapalli, Tanjore, Ramnad and Tirunelveli. The reduction in yields is expected to be large in the West Godavari district, on account of the damage caused by the recent cyclone, and in the Chingleput district due to delayed and insufficient rains.

Condition of standing crop: The standing crop of paddy is reported to have suffered extensive damage in the Circars districts, as a result of the floods and the cyclone which swept these districts recently. The damage to crops is expected to be severe in the districts of East Godavari, West Godavari and Krishna, Where

almost all the standing crops have been affected and consequently the yields are expected to be vary much reduced in those districts. In the Vishakhapatnam district the condition of the standing crop is reported to be not fair, due to damage caused by floods. In the Guntur district the loss to crops is not expected to be so severe. The paddy crop in the low-lying areas of Ongole, Tenali, Bapatla and Repalli taluks were submerged and were damaged to some extent, but the condition of the crop in the other taluks is reported to be fair. In the Deccan, the standing crop is reported to be generally satisfactory in Kurnool and Bellary districts. The crop in the Anantapur and Cuddapah districts has been affected to some extent by want of timely rains, but the prospects are generally fair. The condition of the crop in the Nellore district is fair and prospects are good, more rains are needed in some of the upland taluks. In the Chingleput and South Arcot districts the crop have been adversely affected due to delay in the setting in of the North-East monsoon and in-adequate supplies of water in irrigation sources. The crops are reported to be withering in four taluks in Chingleput district and in two taluks in the South Arcot District. More rains are urgently needed in those districts. In the Central districts the condition of the crop is reported to be satisfactory in Tiruchirapalli district. In the other district the crop is generally fair, but more rains are urgently needed. Supplies of water in irrigation sources are reported to bo in-adequate in the North Arcot and Salem districts and in the Pudukottai division. The condition of the crop in the Southern districts is reported to be below the normal due generally to delayed rains. In the Ramnad and Tirunelveli districts supplies of water in irrigation acources have not been adequate and the prospects of the crop are not encouraging. The progress of the crop in the districts of Malabar, South Kanara and the Nilgiris is reported to be satisfactory and yields are expected to be normal or nearly normal. The paddy crop was also attacked by insect pests in certain parts of the Vishakhapatnam, Chingleput, Salem, Coimbatore and Nilgiris districts, but adequate remedial measures are reported to have been taken to check their spread. The average wholesale price of paddy, 2nd sort, per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important market centers, on 12th November, 1949, was Rs. 7—15—0 in Nellore, Rs. 8—1—0 in Eluru, Rs. 8—2—0 in Nagapatnam, Rs. 8—6—0 in Tiruchirapalli, Rs. 8—8—0 in Kumbakonam and Tirunelveli, Rs. 8—10—0 in Vijayawada, Rs. 8—11—0 in Cuddalore and Rs. 8—15—0 in Masulipatam. (Economic Adviser, Government of Madras.)

Cotton Raw, in the Madras Presidency: (All figures in bales of 392 lb.) The receipt of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 2—12—1949 amounted to 3,92,717 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 3,46,686 bales. 5,26,402 bales mainly of pressed cotton were received at spinning mills and 9,184 bales were exported by sea while 1,01,092 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture.)

Weather Review — For November 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	0·0	—3·9	37·7
	Calingapatam	0·2	—3·2	33·6
	Vizagapatam	0·0	—4·7	38 7
	Anakapalle*	1·8	—1·2	49·1
	Samalkot*	0·0	—5·2	45·0
	Kakinada	12·0	+6·4	58·1
	Maruteru*	0·6	—4·1	48·9
	Masulipatam	23·9	+18·1	64·8
	Guntur*	0·7	—1·7	38·2
	Agrl. College, Bapatla*	3·3	—1·4	51·7
	Veeravanam* (College Farm)	2·7	(x)	51·3
Ceded Dists.	Kurnool	0·6	—0·6	41·9
	Nandyal*	2·3	+0·9	39·4
	Hagari*	0·1	—1·5	18·6
	Siruguppa*	1·1	—0·1§	31·4
	Bellary	0·6	—1·4	19·1
	Rentichintala	2·1	+0·2	30·7
	Cuddapah	3·1	—0·4	34·2
	Ananthrajpet*	8·2	—2·1	48·3
Carnatic.	Nellore	4·4	—7·3	39·7
	Buchireddipalem*	4·7	—10·2	34·3
	Madras	6·9	—7·1	38·2
	Tirurkuppam*	10·1	—2·6$	54·2
	Palur*	3·0	—13·7	31·8
	Tindivanam*	2·1	—7·6	25·0
	Cuddalore	4·3	—11·2	29·3
Central.	Vellore	2·3	—5·4	41·3
	Gudiyatham*	1·4	—4·6	40·1
	Salem	0·7	—3·1	32·8
	Coimbatore (A. C. R. I.)*	1·6	—4·0	16·5
	Coimbatore (C. B. S.)*	1·7	—4·5	16·8
	Coimbatore	0·8	—3·2	18·4
	Tiruchirapalli	2·5	—4·5	38·1

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	6·1	—11·4	28·8
	Aduturai*	7·6	—5·0	33·1
	Pattukottai*	3·9	—6·0	26·0
	Mathurai	3·7	—2·0	38.5
	Pamban	15·5	+3·8	31·4
	Koilpatti*	5·3	—2·3	24·5
	Palamcottah	5·4	—2·0	20·5
	Ambasamudram*	8·1	—3·8	20·9
West Coast.	Trivandrum	3·3	—3·2	56·8
	Fort Cochin	4·2	—2·5	139·0
	Kozhikode	1·5	—5·9	138·5
	Pattambi*	2·0	—3·7	98·7
	Taliparamba*	0·3	—5·9	164·5
	Nileshwar*	0·0	—6·6	169·4
	Pilicode*	0.2	—5·9$	160·2
	Mangalore	0·1	—3·8	159·7
	Kankanady*	0·2	—4·0	161·8
Mysore & Coorg.	Chitaldrug	0·6	—1·8	17·3
	Bangalore	0·1	—2·6	42·1
	Mysore	0·0	—2·7	28·4
	Mercara	0·2	—2·8	120·9
Hills.	Kodaikanal	7·7	—2·5	50·1
	Coonoor*	13·8	—1·0	48·7
	Ootacamund*	1·4	—7·3	41·5
	Nanjanad*	1·4	—5·6	48·8

Note:—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal.
(3) x Readings are being recorded only from February 1948.
(4) § Taluk office rainfall is 1·4" and normal is 1·7"
(5) $ Average of six years data for Tirurkuppam and seven years data for Pilicode is given as normal.

Errata:— The Rainfall data given for Pattukkottai in the October, 1949 issue may kindly be deleted.

Weather review for November 1949

The month commenced with a shallow trough of low pressure in the East Arabian sea off Malabar Konkan Coast. On 3—11—1949 conditions became favourable for the setting in of the North-East Monsoon along the Coramandel Coast. Two days later unsettled conditions were noted in the Andaman sea which persisted for about four days, particularly in the North Andaman sea. On 10—11—1949 the trough of low pressure became marked in the Bay of Bengal and continued to be so in the different portions of the Bay for about three days. Afterwards conditions in the extreme South-West Arabian sea also were markedly unsettled. The anti-cyclone over the Western Pakistan and South-West India became equally marked rather simultaneously.

The North-East Monsoon was found to be setting in along the Coramandel Coast on 16—11—1949. On the same day, night temperatures rose appreciably in the Madras Presidency outside Malabar and in East Hyderabad. For about two days the activity of the North-East Monsoon was felt in Madras Presidency, where local thunder rain occurred. In the last week of the month the North-East Monsoon was found to be strong in the Andaman Sea and the Bay of Bengal. Weather was on the whole dry throughout the month barring the days on which monsoonic showers were received. On 10—11—1949, Ootacamund recorded a minimum temperature of 30°F., which happened to be 19° below the corresponding normal. The North-East Monsoon showers happend to be far below the respective November normals for the various districts in the Madras Presidency. Particulars of the note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches.
8—11—1949	Pachiparai near Nagercoil	5·0
17—11—1949	Madras (Meenambakkam)	5·0
17—11—1949	Madras (Nungambakkam)	4·0
17—11—1949	Nellore	4·1
17—11—1949	Ongole	4·1
17—11—1949	Cuddapah	3·0
21—11—1949	Pamban	3·8
21—11—1949	Alleppey	2·6
21—11—1949	Negapattam	2·2

Agricultural Meteorology Section, Coimbatore, Dated 12—12—1949.

C. B. M.

Departmental Notifications—Posting and Transfers.

GAZETTED SERVICE

Name of Officers	From	To
Sri Nataraj, T.	Junior Lecturer in Agriculture, Bapatla,	Gazetted Assistant to Director of Agriculture. Madras.
,, Ramaswami, K.	Teaching Assistant in Agriculture, Coimbatore,	Assistant Marketing Officer, Madras.

SUBORDINATE SERVICE

Arunachalam, S. -- Assistant in Paddy A. R. S., Aduturai, Paddy Assistant Seed Development Scheme, Mayavaram; Bala Raj, C. J. — A. D., Kumbakonam. F. M., A. R. S., Aduthurai; Bharathan, P. — P. P. A. (Mycology) Tanjore, P. P. A (Entomology) Salem; Bhukta, N. K. — A. D. (Narannapata, A. D. Ichapuram); Bapayya, D. — F. M. A. R. S. Lam Guntur, A. D. Repalle; Balasubramaniam, R. — A. D. Melur, Special A. D. Koilpatti; Duraiswami Iyer, G. — Retired F. M. Pudukottai State, F. M. Town Farm and A. D. Eastern Division, Pudukottai: Habibulla, K. S. — On leave, A. A. D. Pathapatnam; Krishnaswami, P. — On leave, Asst. in Millets, Coimbatore; Kuppamuthu, K. — Special A. D. Cotton Scheme, Srivilliputtur. Teaching Asst. in Agriculture, Coimbatore; Kolukutti Menon, M. — Asst. in Paddy A. R. S., Pattambi, Pepper Asst. Malabar; Krishnamurthi, P. S. — A. D. Wallajah, A. A. D. Kallakuruchi; Krishnamurthi, R. - A. D. Papanasam, P. A. to D. A. O. Tanjore; Lakshmanan, V. — A. D. Cotton Scheme, Coimbatore, A. A. D. Sivaganga; Muthaiah, V. — Asst. in Chemistry, Coimbatore, A. A. D. Mathurai; Mutharasan, G. — Asst. in Cotton, A. R. S. Palur. A. D., Papanasam; Narasimhachari, R. — On leave, P. P. A. (Mycology), Tanjore: Narayana Rao, D. — Teaching Asst. in Chemistry, Bapatla, Chemical Analyst. Bapatla; Narasimhalu, T. R. — P. P. A. (Entomology) Salem, A. D. Palladam. Natarajan, C. P. — Asst. in Chemistry, Coimbatore, Chemical Analyst, Coimbatore. Narasimha Reddy, R. — Soil Conservation Asst. Contour Bunding Scheme, Bellary. A. D., Cuddapah; Prabakara Rao, C. — A. D. Cuddapah, Contour Bunding Scheme. Bellary; Periaswami, S. — Assistant in Entomology Coimbatore, Assistant in Entomology, Shenbaganur; Ramadoss, A. — Millet Asst. Seed Development Scheme Nilakottai, A. D. Mathurai; Ranganathachar, N. — F. M. A. R. S. Aduthurai, A. D. Kumbakonam; Ratnakar Bhatkal, — F. M. — Livestock Research Station, Hosur. A. A. D. Udipi; Rama Mohana Rao, R. M. V. — A. D. Rapallo, F. M. A. R. S. Lam Guntur; Rajagopalan, K. — Asst. in Paddy, Coimbatore, Paddy Asst. Seed Development Scheme, Trichy; Rajogopalan, D. S. — Asst. in Paddy, Coimbatore, A. A. D. Devakottai; Radhakrishna Rao, K. — Asst. in Entomology, Shenbaganur, A. A. D. Kasargod; Raghavendrachar, C. — Asst. Agricultural Chemist, Coimbatore, Asst. in Chemistry, Coimbatore; Raman, K. R. — Fruit Asst. Wynad, A. D. Uthamapalayam; Ramaswami, N. — Special A. D. Cotton Scheme, Tirupur, F. M. Livestock Research Station, Hosur; Sethu Madhavan, R. — Asst. in Millets, Coimbatore, A. D. Melur; Satyanarayana, S. B. — A. D. Ichapuram, A. D. Narasannapatam. Sankaranarayana Iyer, C. V. — On leave, Asst. in Paddy, Coimbatore; Subramaniam, J. — Asst. in Fruits, Kodur, A. D. Kandukur; Syed Ahamadulla, - On leave, Millet Asst. Seed Development, Narasaraopet; Subramania Chetty, M. - F. M. A. R. S. Koilpatti, Special A. D. Cotton Scheme, Koilpatti; Srinivasan, K. F. M. Central Farm Coimbatore, A. D. Gingee; Srinivasan, S. T. — Asst. in Paddy A. R. S. Aduthurai, Paddy Asst. Seed Development Scheme, Sattur; Srinivasa Rao, B. — Pulses Asst. Coimbatore, A. D. Udipi; Sadasiva Shetty, Y. — Cotton

Asst. Coimbatore, A. A. D. Kasargod; Subba Rao, P. — A. D. Cheerupalle, A. D.› Vuyyuru ; Subramania Iyer, G. K. — On leave, A. D. Wallajah; Sambandam, R. — A. D. Palladam, F. M. A. R. S. Koilpatti; Suryanarayan, S. — F. M., A. R. S. Koilpatty, A. D. Palladam; Shanmugham, S. — F. M. Town Farm and A. D. Eastern Division Pudukottai, Special A. D. Sugarcane Scheme, Hospet; Subramaniam, J. — Fruit Asst. A. A. D. Chandragiri; Varaprasada Rao, T. — A. D. Vuyyur, A. D. Cheeprupalle.

The following postings of Assistant Inspectors of Fertilisers are ordered :

Names		Head-quarters.
Sri Ramalingam, G.	A. D. Kandukur,	Guntur.
.. Rajagopal, V. V.	On leave,	Coimbatore.
,, Ramaratnam, W. S.	A. D. Cuddalore.	Madras.
,, Seetharaman, P. M.	A. D. Uthamapalayam,	Mathurai.
.. Seethapathi Rao, S.	A. D. Pithapuram,	Cuddapah.

The following subordinates are appointed as upper-subordinates and posted to the vacancies shown against each :—

Janab Abdul Sattar — A. A. D. Palladam; Ayyappan, T. — F. M. A. R. S. Nileshwar; Adiyapatham, A. — Asst. in Cotton, A. R. S. Palur; Adiraja Kanniah, D. — A. A. D. Musiri; Ananthanarayanan, S. S. — Asst. in Cotton Winter Scheme, Coimbatore; Achutha Menon, N. K. — Asst. in Fruits, Mettupalayam; Appalanarasaiah, P. — F. M. Araku Valley; Bhimasastry, A. — Asst. in Paddy A. R. S. Maruteru; Syed Ruknuddin — Pepper Asst. Malabar; Chidambaram Pillai, K. — A. A. D. Dindigul; Janardhana Rao, T. V. — F. M. A. R. S. Siruguppa; Krishnan, C. H. — Asst. in Cotton Winter Scheme, Coimbatore; Krishnamaraj, N.— Asst. in Cotton Tinnies Scheme, Coimbatore; Kannaiah Naidu, A. K. — Asst. in Millet Seed Development Scheme, Attur; Krishnaswami Naidu, R. — F. M. Central Farm, Coimbatore; Krishnaswami, A. V. — Asst. in Oilseeds, Tindivanam; Kuppamuthu, C. K. — A. A. D. Vellore; Manuel, J. — Asst. in Paddy, Coimbatore; Marudachalm, K. P. — Asst. in Mycology, Coimbatore; Muhammad — Asst. in Paddy A. R. S. Pattambi; Meenakshisundaram, K. — Asst. in Pulses, Coimbatore; Narayana Rao, K. — Asst. in Mycology, Coimbatore; Narayanaswami Iyer, C. S. — Asst. in Paddy A. R. S. Aduthurai; Narasimham, K. V. — F. M. A. R. S. Hagari; Ponnuswami Pillai, D. — Pepper Asst. Malabar; Palaniappan, K. K. — Asst. in Cotton, Coimbatore; Pitchamuthu, C. M. — Pepper Asst. Malabar; Ponnan, P. — Pepper Asst. Malabar; Prasada Rao, K. — Millet Asst. A. R. S. Nandyal; Ramakrishna Rao, K. Bh. V. — A. D. Hadagalli (Bellary Dist.); Ramachandra Rao, K.— F. M. Bhagavathi Farm, Siruguppa; Rama Rao, C. V. — A. A. D. Kadiri; Raghavachari, R. — Asst. in Paddy A. R. S. Aduthurai; Ramachandran, G. — A. A. D. Mannargudi; Raghavachar, S. — Assistant in Oilseeds, Tindivanam; Raju, D. E. — F. M. A. R. S. Hagari; Samuel Christian, D. — Special A. D. Tirupur; Sitaramaiah, K. — A. A. D. Kurnool; Satyanarayana, B. — A. D. Hadagalli; Sreeramamurthi, Y. — A. A. D. Chandragiri; Srinivasa Iyengar, V. — Special A. D. Coimbatore Cotton Scheme, Srivilliputhur; Subba Naidu, T. — Asst. in Cotton A. R. S. Koilpatti; Sivaramakrishnaiah, M. — Soil Conservation Asst. Contour Bunding Scheme, Bellary; Theetharappa Mudaliar, R. N. — A. A. D. Sattur; Venkataraman, C. R. — A. A. D. Kumbakonam; Venkataraman, T. V. — Pepper Asst. Malabar; Venkataraman, K. — Asst. in Chemistry, Coimbatore; Valisi Naidu, K. — Millet Asst. Seed Development Scheme, Anakapalle; Venkataswami, V. — Soil Conservation Asst. Contour Bunding Scheme, Bellary; Veeraraghava Rao, K. — A. D. Rapur.

ANDHRA UNIVERSITY

Successful Candidates in B. sc., Degree Examination in Agriculture — October, 1949.

First Examination :— *Passed in Agricultural :* 11, 12, 16, 20, and 22 ; *Passed in Botany :* 13 and 22 ; *Passed in General and Soil Chemistry :* 4, 9, 19 and 29 ; *Passed in Zoology :* 6, 17 and 22 ; *Passed in Agricultural Engineering (Civil) :* 2, 3, 4, 5, 7, 8, 14, 18, 21, 23, 24, 25, 26, 27, 28 and 30.

Second Examination :— *Passed in Agriculture Plant Husbandry 1 :* 33 and 53; *Passed in Agricultural Botany (Crop Botany and Plant Breeding and Genetics) :* 33, 37, 38, 41, 42, 43 and 52 ; *Passed in Agricultueal Chemistry (Orginic Chemistry and Plant Chemistry) :* 32, 33, 34, 35, 36, 39, 40. 41, 42, 44, 46, 47, 48, 49 and 50 ; *Passed in Agriculture Entomology :* 33 only ; *Passed in Agricultural Engineering (Mechanical) :* 33, 40, 41, 42, 43, 45, 51 and 53.

Final Examination :— Socond Class : 55, 56, 57, 61, 62, 63, 64, 66, 67, 68 and 69 ; *Passed in Agriculture - Horticulture :* 58 and 59 ; *Passed in Agri-culture - Animal Husbandry and Dairying :* 59 only ; *Passed in Botany - (Plant Pathology) :* 54, 58 and 59 ; *Passed in Agricultural Chemistry :* 54 only ; *Passed in Animal Hygiene :* 59 and 60,

PRINCIPAL,
Agricultural College, Bapatla.

Agricultural College and Research Institute, Coimbatore

LIST OF ADDITIONS TO LIBRARY FOR NOVEMBER 1949.

1. BONNIER (Gert) and LARSON (Robert): Ed. Proceedings of the VIII International Congress of Genetics Stockhohm. 1949.
2. BRWON (W. H.): Plant Kingdom — A text book of General Botany. 1935.
3. FLORKIN (M): Ed. Biochemical evolution. 1949.
4. FLOSDORF (E): Freeze drying — drying by sublimation. 1949.
5. GARNER (F. H.): Cattle of Britain. 1946.
6. HALNAN (E. T.): & GARNER (F. H.): Principles & Practice of Feeding farm animals. 1946.
7. HANDFORD (C. G.): Folliicolous Ascemycetes, their parasites and associated Fungi. 1946.
8. HARDIN (G): Biology — its human implication. 1949.
9. HARRIS (Robert S.): & THIMAN (K. V.): Vitamins and Hormones. 1948.
10. JASNY (N): Socialised agriculture of the U. S. S. R. plants and performance. 1949.
11. LITTLE (A) & MITCHELL (K. A.): Tablet making. 1949.
12. MARTIN (J. H.) & LEONARD (W. H.): Principles of field crop production. 1949.
13. MRAK (E. M.) & STEWART (G. T.): Advances in food Research. 1948.
14. PFEIFFER (E): Soil fertility renewal and preservation. 1947.
15. PINCUS (G) & THIMAN (K. V.): Hormones, physiology, Chemistry and applications. 1948.
16. POOL (R. J.): Marching with the grasses. 1948.
17. VUREN (J. P. J.): Soil fertility and sewage. 1949.
18. WRENCH (G. T.): Reconstruction by way of the soil. 1946.
19. BRITAIN: Can breed it-Livestock of British Isles reviewed.
20. ENGLAND (I): Commonwealth Agricultural Bureau, Proceedings of the first Commonwealth conference on tropical and subtropical soils. 1948 — 1949.
21. LONDON: Central office of Information: Post-war Britain. 1948 — 1949.
22. LONDON: Chemical society: Annual report on the progess of Chemistry. 1948 — 1949.
23. INDIA (Delhi): Preparatory Asiatic Regional Conference of the International Labour Organisation — Report I problems of Social security. 1947.
24. .... Report II Labour policy in general including the enforcement of labour measures. 1947.
25. .... Report III programme of action for the enforcement of social standards embodied in conventions and recommendations not yet satisfied or accepted. 1947.
26. .... Report IV Economic background of Social policy including problems of industrialisation. 1947.
27. INDIA (Deccan Sugar Technologists Association: Proceedings of the fifth Annual convention. Pt. I. 1948.
28. ENGLAND: Imperial Institute of Entomology: Report of fifth Commonwealth Entomological conference. 22 — 30 July, 1948.

D. B. K.